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Docket No.: 06618/201/CIT3061

## WHAT IS CLAIMED IS:

- 1 L. A method of performing finite element analysis on a shell including:
  - \(a) modeling the geometry of the shell using subdivision surfaces;
- characterizing an environment for the shell, including environmental factors
  affecting the mechanical behavior of the modeled shell;
  - (c) computing the mechanical response of the modeled shell, taking into account the characterized environment, using a finite element analysis; and
  - (d) outputting a description of the geometry of the modeled shell as determined from the computed mechanical response.
  - 2. The method of claim, wherein the environment factors includes loading conditions, material properties, and boundary conditions for the modeled shell.
  - 3. The method of claim 2, wherein the loading conditions includes an indication of applied forces.
  - 4. The method of claim 2, wherein the loading conditions includes an indication of thermal loading.
  - 5. The method of claim 1, further including outputting indications of the characterized environment.
- 6. The method of claim 1, wherein the finite element analysis uses subdivision basis
   functions as shape functions.
- 7. The method of claim 1, wherein the finite element analysis uses suitably smooth shape functions.

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- 8. A method for performing finite element analysis using subdivision basis functions, 1 2 including:
  - (a) inputting a mesh comprising a set of data points each having connectivity to neighboring data points, the mesh defining physical parameters;
  - (b) specifying an initial state for the mesh;
  - defining a set of linear differential equations comprising a stiffness matrix and an external forcing vector, at least one such equation having a fourth order differential operator;
  - solving the set of linear equations as applied to the mesh; (d)
  - outputting the solution to the set of linear equations as defining a modification of the (e) initial state of the mesh based on the stiffness matrix and in response to the external forcing vector.

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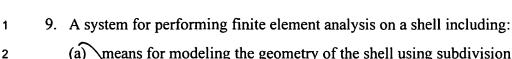
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- - (a) means for modeling the geometry of the shell using subdivision surfaces;
  - (b) means for characterizing an environment for the shell, including environmental factors affecting the mechanical behavior of the modeled shell;
    - (c) means for computing the mechanical response of the modeled shell, taking into account the characterized environment, using a finite element analysis; and
    - (d) means for outputting a description of the geometry of the modeled shell as determined from the computed mechanical response.
  - 10. The system of claim 9, wherein the environment factors includes loading conditions, material properties, and boundary conditions for the modeled shell.
  - 11. The system of claim 10, wherein the loading conditions includes an indication of applied forces.
  - 12. The system of claim 10, wherein the loading conditions includes an indication of thermal loading.
  - 13. The system of claim 9, further including means for outputting indications of the characterized environment.
- 14. The system of claim 9, wherein the finite element analysis uses subdivision basis 1 functions as shape functions. 2
- 15. The system of claim 9, wherein the finite element analysis uses suitably smooth shape 1 functions. 2

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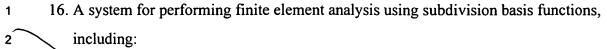
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- (a) means for inputting a mesh comprising a set of data points each having connectivity to neighboring data points, the mesh defining physical parameters;
- (b) means for specifying an initial state for the mesh;
- (c) means for defining a set of linear differential equations comprising a stiffness matrix and an external forcing vector, at least one such equation having a fourth order differential operator;
- means for solving the set of linear equations as applied to the mesh; (d)
- (e) means for outputting the solution to the set of linear equations as defining a modification of the initial state of the mesh based on the stiffness matrix and in response to the external forcing vector.

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- 1 17. A computer program, residing on a computer-readable medium, for performing finite
  2 element analysis on a shell, the computer program comprising instructions for causing a
  3 computer to:
  - (a) model the geometry of the shell using subdivision surfaces;
- 5 (b) characterize an environment for the shell, including environmental factors affecting 6 the mechanical behavior of the modeled shell;
  - (c) compute the mechanical response of the modeled shell, taking into account the characterized environment, using a finite element analysis; and
  - (d) output a description of the geometry of the modeled shell as determined from the computed mechanical response.
  - 18. The computer program of claim 17, wherein the environment factors includes loading conditions, material properties, and boundary conditions for the modeled shell.
  - 19. The computer program of claim 18, wherein the loading conditions includes an indication of applied forces.
  - 20. The computer program of claim 18, wherein the loading conditions includes an indication of thermal loading.
  - 21. The computer program of claim 17, further including instructions for causing the computer to output indications of the characterized environment.
- 22. The computer program of claim 17, wherein the finite element analysis uses subdivision
   basis functions as shape functions.
- 23. The computer program of claim 17, wherein the finite element analysis uses suitably smooth shape functions.

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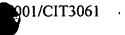
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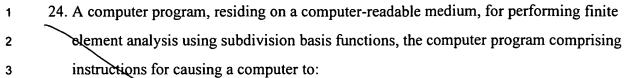
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- (a) input a mesh comprising a set of data points each having connectivity to neighboring data points, the mesh defining physical parameters;
- (b) specify an initial state for the mesh;
- (c) define a set of linear differential equations comprising a stiffness matrix and an external forcing vector, at least one such equation having a fourth order differential operator;
- (d) solve the set of linear equations as applied to the mesh;
- output the solution to the set of linear equations as defining a modification of the (e) initial state of the mesh based on the stiffness matrix and in response to the external forcing vector.